Department of Pesticide Regulation
Environmental Monitoring Branch
1001 I Street
Sacramento, CA 95812
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STUDY #234: The effectiveness of the Wingsetter Ranch created wetland at reducing chlorpyrifos in irrigation runoff

I. INTRODUCTION

Wingsetter Ranch is located directly adjacent to west bank of the San Joaquin River in Stanislaus County. It once was approximately 3 to 5 acres of mostly barren, flood-prone farmland that has now been restored to a productive wetland. Restoration was possible in part due to Natural Resources Conservation Service (NRCS) programs that help farmers bring flood-prone fields back to functioning wetlands. With the added help of Ducks Unlimited and the Wetland Conservation Board, the property owner was able to create a network of waterways, sediment basins and sloughs. The created wetland intercepts and filters sediment from agricultural tailwaters from approximately 4000 acres of row and orchard croplands. It also provides habitat for wildlife. Though constructed to capture and reduce sediment from entering into the San Joaquin River, this study will test whether the created wetland is also effective in reducing dissolved pesticides in tailwater runoff.

II. OBJECTIVE

The primary objective of this study is to determine the effectiveness of a constructed wetland in reducing chlorpyrifos mass in discharge under flow-through conditions during the irrigation season.

III. PERSONNEL

This is a cooperative study between the Department of Pesticide Regulation (DPR) and the San Luis and Delta Mendota Water Authority. Funds for this project have been provided by California State Proposition 13 (2000 water bond), Prism Grant Program. The study will be conducted by staff from DPR's Environmental Monitoring Branch, Surface Water Protection Program under the general direction of Kean S. Goh, Agricultural Program Supervisor IV. Key personnel are listed below:

Project Leader:	Juanita Bacey
Field Coordinator:	Student staff
Senior Scientist:	Frank Spurlock
Laboratory Liaison:	Carissa Ganapathy
Chemists:	California Dept. of Fish and Game

Questions concerning this monitoring study should be directed to Juanita Bacey, Environmental Research Scientist, at (916) 445-3759.

IV. STUDY PLAN

Total chlorpyrifos mass entering and exiting the wetland in a one-month period will be estimated. Mass will be calculated by measuring chlorpyrifos concentrations and inflow volume and discharge. Monitoring will occur after peak pesticide applications to surrounding agricultural areas have occurred. Additionally, other organophosphates and select pesticides in water will be measured (Table 1). Samples will be collected during the month of July 2006. July has been the month with the highest reported chlorpyrifos use in both 2003 and 2004 (DPR PUR, 2005) in Stanislaus County where the wetland is located. Water and sediment samples will be collected from the main inlet (back drain) and at the two outlets. Water quality measurements to be measured *in situ* at each sampling point include specific conductance, pH, DO and temperature. Additionally, staff from the U.C. Davis Department of Land, Air and Water Resources will measure the volume of water entering and exiting the wetland.

Table 1. Pesticides to be monitored

Organophosphates	Other Pesticides
Chlorpyrifos	Aldicarb
Chlorpyrifos methyl	Captan
Diazinon	Carbaryl
Dichlofenthion	Carbofuran
Dioxathion	Diuron
Ethion	Linuron
Fenchlorphos (Ronnel)	Methiocarb
Fenitrothion	Methomyl
Fonofos (Dyfonate)	
Malathion	
Ethyl parathion, also Parathion	
Methyl parathion	
Phosphamidon	
Ethoprop (Prophos)	
Sulfotep	
Thionazin (Thionzin)	
Tokuthion (Prothiofos)	
Merphos (Tributylphosphorotrithioite)*	
Trichloronate	

V. SAMPLING METHOD

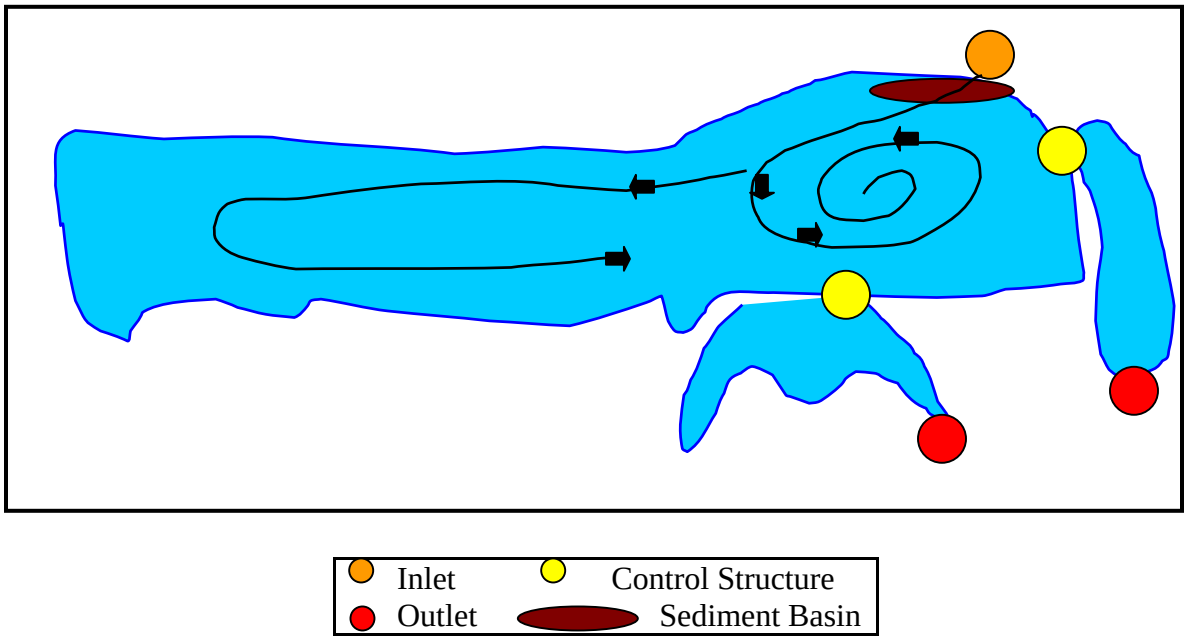
Prior to the start of monitoring, water residence time within the wetland will be estimated. A tracer will be added to the inlet. Sampling of both outlets will occur hourly during likely peak concentration times and less frequently (2 to 12 hours) during likely non-peak concentration times. Samples will be analyzed using a Eureka Manta® multi-parameter probe or other tracer appropriate equipment. The wetland residence time will be estimated during the month of June, when irrigation practices are similar to those in July, and at a time when average irrigation runoff is occurring.

Upon review of residence time data, the frequency of pesticide sample collection may be modified from that described below.

Water samples – Samples will be collected using ISCO® autosamplers, as per DPR SOP #EQWA005.00 (Jones, 2000). Autosamplers will be placed at each inlet and outlet. Samples will be collected every 12 hours, seven days a week, during July 2006 (Figure 1).

Water quality measurements - These will be measured every 2 hours using Eureka Manta® multi-parameter probes placed at the inlet and both outlets during the study. Discharge will be measured every 15 minutes.

Figure 1. Portion of Wingsetter ranch created wetland to be monitored



Sample Handling and Custody

Samples will be kept cold within the autosampler using block ice until collected for delivery to the lab. Collection of samples will occur 3 times a week. All sample bottles will be sealed with Teflon-lined lids. Samples will be transported and stored on wet ice or refrigerated at 4^{o}C until extraction for chemical analysis. Transporting of samples will follow DPR SOP #QAQC004.01 (Jones, 1999). A chain-of-custody record will be completed and accompany each sample.

VI. CHEMICAL ANALYSIS AND QUALITY CONTROL

The California Department of Fish and Game, Fish and Wildlife Water Pollution Control Laboratory will conduct chemical analysis of all water and sediment samples. Quality control (QC) will be conducted in accordance with SOP QAQC001.00 (Segawa, 1995) and will include general continuing QC. Ten percent of the total number of samples will be submitted with field samples as blind spikes. Comprehensive chemical analytical methods will be provided in the final report.

VII. DATA ANALYSIS

Pesticide concentrations in water will be reported in micrograms per liter (µg/L). Pesticide concentrations in sediment will be reported in micrograms per gram (µg/g). Total discharge entering and exiting the wetland will be reported. Total monthly chlorpyrifos mass entering and exiting the wetland will be estimated and compared to determine differences in concentrations.

VIII. TIMETABLE

Background sampling:	June 2006
Field Sampling:	July 1 through July 31, 2006
Chemical analysis:	July 1 through August 30, 2006
Preliminary Memorandum:	November 30, 2006
Final Report:	February 28, 2007

IX. BUDGET

Chemistry Analysis				
OPs	2/day x 31 days x 3 sampling points ($266/sample)	186 samples	=	$49,476
Select insecticides and herbicides	2/day x 31 days x 3 sampling points ($266/sample)	186 samples	=	$49,476
Quality Control				
Blind spikes	10% of total water samples ($266/sample)	36 samples	=	$9,576
Subtotal				$108,528
Personnel Services				
Sr. Env. Scientist	$31/hr x 20 hrs			$620
Staff benefits	(31%)			$192
Env. Scientist	$25/hr x 200 hrs			$5,000
Staff benefits	(31%)			$1,550
Scientific Aide	$11/hr x 8hrs x 3/wk x 5 wks			$1,320
Staff benefits	(11%)			$145
Student Assistant	$8.40/hr x 8hrs x 3/wk x 5 wks			$1,008
Overhead	$9,835 x 20%			$1,967
Subtotal				$11,802
Operating expenses				
Transportation	$0.34/mi at 180 miles/day x 3/wk x 5 wks			$918
Equipment/supplies	1 L Amber bottles ($40/case)	31 cases		$1,240
	1 Manta multi-parameter probe			$2,850
Subtotal				$5,008
TOTAL				**$125,338**

X. REFERENCES

DPR Pesticide Use Report Database. 2005. Available on-line: www.cdpr.ca.gov/docs/pur/purmain.htm

Jones, D. 1999. SOP #QAQC004.01 - Transporting, packaging and shipping samples from the field to the warehouse or laboratory. Available on-line: http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc0401.pdf

Jones, D. 2000. SOP #EQWA005.00 - Instructions for operating ISCO® samplers when collecting surface water. Available on-line: http://www.cdpr.ca.gov/docs/empm/pubs/sops/FSWA016.pdf

Segawa, R. 1995. SOP QAQC001.00 - Chemistry Laboratory Quality Control. Available on-line: http://www.cdpr.ca.gov/docs/empm/pubs/sops/qaqc001.pdf